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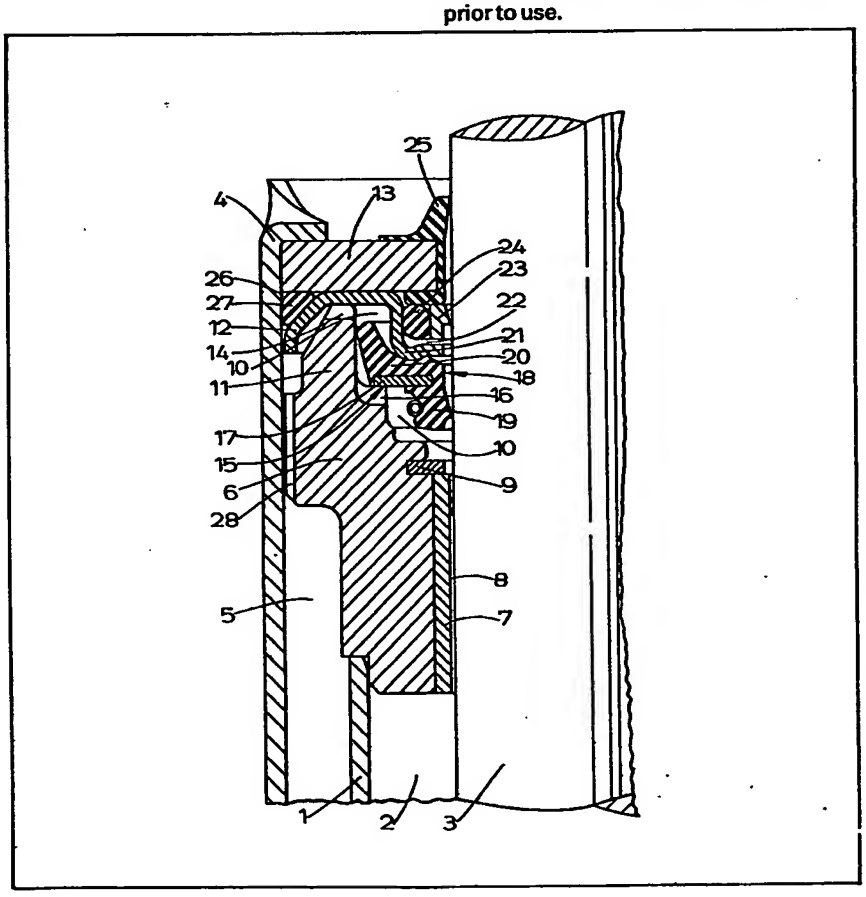
(54) Hydropneumatic damper with gas return valve

(57) An hydraulic damper has a working chamber 2 filled with hydraulic fluid and receiving the working piston and the piston rod 3, and a compensating chamber 5 containing partly hydraulic fluid and partly gas under pressure. The chambers are connected at the upper end through a closure unit which contains a piston rod guide 6 and a sealing device, 19, 20 which seals the piston rod and also acts as a non-return valve allowing flow towards the compensating chamber, but preventing flow in the opposite direction. The sealing device is arranged in a space between the piston rod 3 and a projection 11 on the piston rod guide 6. The non-return valve is formed as an upwardly inclined sealing lip 20 which engages the inside of the projection on the piston rod guide. This prevents damage during assembly and handling prior to use.



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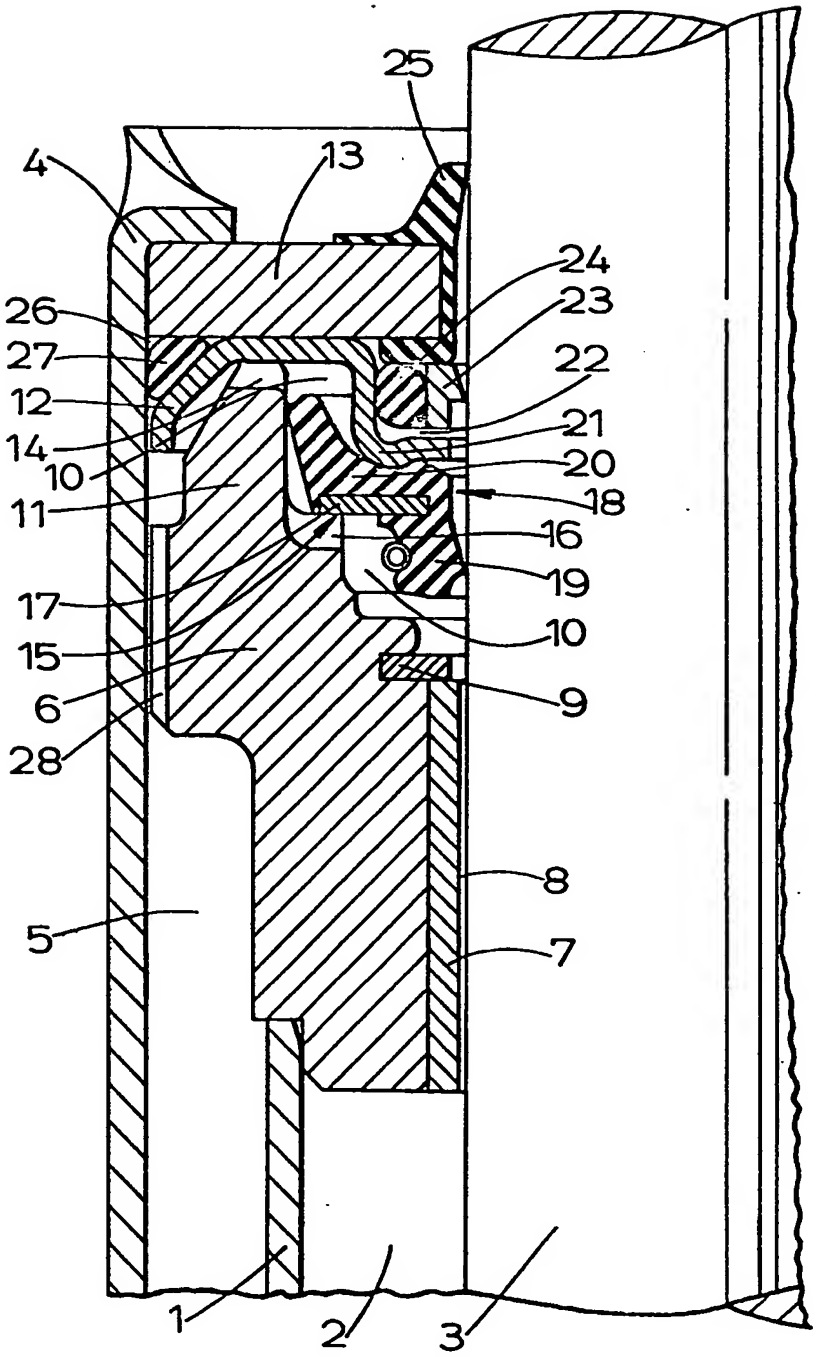
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SPECIFICATION

Telescopic hydraulic damper

The invention relates to a hydraulic damper of telescopic construction, for example for vehicle suspensions, with an inner tube defining a working chamber filled with hydraulic fluid, a surrounding outer cover which defines between itself and the inner tube a compensating chamber partly filled with gas, and a piston rod extending out through a rod guiding body and a sealing device, the sealing device comprising a rod seal and at least one sealing lip serving as a gas seal which engages the rod guiding body in such a manner that it lifts away in the event of flow of hydraulic fluid past the rod guiding body into the compensating chamber but blocks flow in the opposite direction.

Such a damper is described in DE-OS 27 15 826. This telescopic damper, made of two-tube construction, has an inner tube and an outer or cover tube enclosing it. The inner tube defines a working chamber in which a piston guided on a piston rod is axially movable. The working chamber is connected to a compensating chamber, formed by the enclosing tube, through throttling elements mounted on the base, and the compensating chamber is likewise partly filled with hydraulic fluid but also partly filled with a gas.

At the emerging end of the piston rod there is a rod guiding body which surrounds the piston rod to guide it. There remains between the piston rod and the guiding body an annular gap such that damping fluid can flow from the working chamber through the annular gap upwards and through openings on the outer periphery of the rod guiding body and into the compensating chamber.

Above the rod guiding body there is a sealing device which comprises substantially a rod seal engaging the piston rod and a sealing lip serving as a gas seal. In one embodiment shown in DE-OS 27 15 826 (Figure 3) the sealing device is in the form of a sealing ring which has a sealing edge on its inner face for stripping hydraulic fluid from the piston rod and has on its outer face two sealing lips which face downwards, that is to say in the direction of the compensating chamber, of which one engages the enclosing tube and the other engages the outside of the piston guiding body. This last one serves as a gas seal with respect to the working chamber. However hydraulic fluid coming from the working chamber can flow in the opposite direction into the compensating chamber as this hydraulic fluid then lifts the sealing lip away.

On its upper face the sealing ring has a reinforcing plate. The latter is engaged by a spring which presses the sealing ring against the rod guiding body. The remaining embodiments illustrated in this publication likewise have similar design and construction.

The known telescopic dampers described above have various drawbacks. A particular drawback is the fact that the seating for the sealing lip serving as the gas seal is on the outside of the rod guiding body. For this reason the seating is unprotected against damage during manufacture, shipping, mounting and assembly. Furthermore there is also the danger of damaging the sealing lip on assembly when it is forced over the rod guiding body. As it has a radially inwardly directed pre-loading, it must be distended for this purpose so that it can be slipped over the upper external rim of the rod guiding body. Moreover this is also unfavourable from the assembly point of view.

The invention is based on the requirement to overcome the drawbacks of the known hydraulic dampers, in particular to provide a seal in the upper part of the hydraulic damper referred to above which is easy to manufacture and without the danger of damage, and which furthermore should also be attractive from the point of view of cost.

This problem is solved according to the invention in that the sealing device is arranged in an annular space formed by the piston rod and an annular projection or collar on the rod guiding body and the sealing lip is formed on the rod seal to extend in an upwardly inclined direction and to engage the inside of the annular projection or collar.

On the basis of this construction the seating for the sealing lip serving as the gas seal engages against the inside of the rod guiding body within an annular space where it is well protected against damage in manufacture, shipping, mounting and assembly. Moreover the feature that the sealing lip is directed in an upwardly inclined direction is extremely favourable towards assembly as this can then be slipped into the annular chamber easily and without danger of damage. The latter can in addition be still further favoured if the inner upper corner of the annular projection or collar is rounded off. An added advantage lies in the favourable cost of this sealing device.

According to the invention it is further provided that a stiffening sheet metal body is embedded in the sealing device and axially clamped between a notched shoulder on the rod guiding body and an upper closing-off device. This results in a simple yet rigid clamping of the sealing device in an axial direction. The stiffening sheet should be left exposed for direct engagement on the shoulder but on its upper face it may be provided with an elastomeric layer in order to maintain secure and rigid clamping without the tolerance problems created by trying to make different components engage against different faces simultaneously.

The closing-off device can for example comprise a closing metal sheet retained by the outer tube and a shaped sheet metal component engaging against it on the inside, with the pot-shaped inner edge of the latter, drawn into the annular space, engaging the upper face of the sealing device. resulting in a particularly simple design. In this arrangement, in order to clamp the rod guiding body securely as well, its annular projection should engage the sheet metal shaped component at its upper end and should have notches or openings above the sealing lip for allowing flow of the hydraulic fluid from the working chamber to the compensating chamber.

According to a further feature of the invention it is provided that a further annular chamber for receiving a cold seal is formed by the pot-shaped drawn-in inner edge of the sheet metal shaped component.

This cold seal can for example comprise a PTFE ring which is surrounded by an O-ring.

Finally it is proposed according to the invention that the sheet metal shaped component should be bent downwards at its outer rim to define an additional space in which there is mounted a second O-ring to form a static oil and gas seal.

An embodiment of the invention will now be described by way of example only, with reference to the accompanying drawing, which is a vertical section through the left hand half of the upper part of an hydraulic damper. Its inner tube 1 defines an oil-filled working chamber 2, in which a piston, not shown here but secured to a piston rod 3, is movable up and down. Coaxially with the inner tube 1 there is a surrounding or outer tubular cover 4 which defines a compensating chamber 5. The working chamber 2 and compensating chamber 5 are connected together at their lower ends through throttling elements. The compensating chamber 5 is filled in its lower region to a greater or lesser extent with hydraulic fluid, according to the position of the piston in the inner tube 1. There is a gas present in its upper region.

Mounted on the upper end of the inner tube 1 is a rod guiding body 6. It comprises a guide bush 7 which leaves a clearance 8 for the piston rod 3. The upper end of the guide bush 7 abuts a ring 9 retained by an annular bead formed by staking.

At its upper end the rod guiding body 6 leads into an annular space 10 defined by an axially extending annular projection or collar 11 on the body 6. Its upper face abuts against a shaped sheet metal component 12 and the latter in its turn abuts against a sheet metal closing component 13. This last mentioned item is retained by the inwardly beaded-over rim of the outer tube 4.

The axially extending annular projection 11 has notches 14 in its upper end. On its inside there is provided a shoulder 15 with gaps or notches 16 formed in it. Against this shoulder 15 lies the outer part of a stiffening sheet metal component 17 which is partially embedded in a sealing device 18. This sealing device 18 comprises a rod seal 19 extending downwards and engaging the piston rod 3, and an outwardly shaped sealing lip 20 extending in an upwardly inclined direction and engaging with pre-loading against the inside wall of the axial projection 11.

The shaped sheet metal component 12 has a pot-shaped deepened portion 21 in the region of its inner edge, this region acting to press the sealing device 18 together with the stiffening sheet metal member 17 tightly against the shoulder 15 and pre-loading it in this way. The pot-shaped deepened portion defines a further annular space 22 in which there is mounted a PTFE sealing ring 23 engaging the piston rod 3 and an O-ring 24 surrounding the PTFE ring, the two forming a cold seal.

Above the cold seal a dust lip seal 25 bearing against the piston rod 3 is vulcanised in the usual way to the inner edge of the closing sheet metal member 13. A further seal is provided between the outer edges of the closing sheet metal member 13 and the shaped sheet metal component 12, the latter being bent downwards to a conical shape in this region. This results in an additional annular space 26 in which a further O-ring 27 is inserted.

When now hydraulic fluid flows upwards from the working chamber 2 through the gap 8 between the rod guiding body 6 and the piston rod 3, it reaches the lower part of the annular space 10, flows through the notches 16 past the stiffening sheet metal member 17 and further to the sealing lip 20, lifting the latter away from the inner wall of the axially extending annular projection or collar 11. The damping fluid can then flow further through the notches 14 in an outward direction and then back downwards, passing through longitudinal passages 28 in the outer wall of the rod guiding body and then reaching the compensating chamber 5. In the opposite direction the sealing lip 20 forms a gas block in the manner of a non-return valve.

CLAIMS

1. An hydraulic damper of telescopic construction, with an inner tube defining a working chamber filled with hydraulic fluid and a surrounding outer cover which defines between itself and the inner tube a compensating chamber partly filled with gas, a piston rod projecting out through a guide bush of a rod guiding body and a sealing device, the sealing device comprising a rod seal and at least one sealing lip serving as a gas seal which engages the rod guiding body in such a way that on flow of hydraulic fluid past the rod guiding body into the compensating chamber it lifts away but it blocks flow in the opposite direction characterised in that the sealing device is arranged in an annular space formed by the piston rod and an annular projection on the rod guiding body and the sealing lip is formed on the rod seal to extend in an upwardly inclined direction and to engage the annular projection on the inside.

2. An hydraulic damper according to Claim 1 in which the annular projection is rounded off on its inner upper edge.

3. An hydraulic damper according to Claim 1 or Claim 2 in which a stiffening sheet metal member is embedded in the sealing device and is axially clamped between a shoulder on the rod guiding body provided with gaps, and an upper closing-off device.

4. An hydraulic damper according to Claim 3 in which the stiffening sheet metal member is left exposed for engagement against the shoulder but on its upper face is provided with an elastomeric layer.

5. An hydraulic damper according to Claim 3 or 4 in which the closing-off device comprises a closing sheet metal member retained by the outer tube and a shaped sheet metal component engaging against it on the inside, the member having a pot-shaped inner edge drawn into the annular space and engaging at its upper face against the sealing device.

6. An hydraulic damper according to Claim 5 in which the upper end of the annular projection on the rod guiding body engages against the shaped sheet metal component, and above the sealing lips it has notches for allowing flow from the working chamber to the compensating chamber.

7. An hydraulic damper according to Claim 5 or Claim 6 in which a further annular space is formed between the pot-shaped drawn-in inner edge of the shaped sheet metal component for receiving a cold seal.

8. An hydraulic damper according to Claim 7 in which the cold seal comprises a PTFE sealing ring engaging against the piston rod and an O-ring surrounding it.

9. An hydraulic damper according to any of Claims 5 to 8 in which the shaped sheet metal component is bent down at its rim to form an additional annular space in which is mounted an second O-ring forming a static oil and gas seal.

10. An hydraulic damper of telescopic construction having a piston rod sealing arrangement substantially as described with reference to and as illustrated in the accompanying drawing.

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